Appendix G

RESPONSE TO TOXIC INDUSTRIAL MATERIALS EVENTS

1. Background

The information in this appendix provides general protective guidance for response to a TIM incident. This appendix provides information on selected TIM information resources, the general means of determining protective-action zones (PAZs), actions that can be undertaken to conduct vulnerability mitigation, and generic precautions.

a. TIM are almost universal in their distribution and are available in amounts that dwarf the amounts of CW agents ever produced. Industrial materials include chlorine, ammonia, solvents, and pesticides, fertilizers, and petrochemicals and are extensively used in the manufacture of plastics. TIM are used within industrial plants, sold and transported to other plants, and distributed through commercial and retail outlets. TIM can be found in almost every town, city, or country in the world, whether in a chemical industry, a warehouse, a rail yard, or an agricultural supply company.

b. The American Chemical Manufacturers Association (CMA) estimates that over 25,000 commercial facilities worldwide produce, process, or stockpile chemicals that fall within the purview of the Chemical Weapons Convention. These include dual-use chemicals, which can be used both for legitimate industrial purposes and as CW agents. Each year, more than 70,000 different chemicals amounting to billions of tons of material are produced, processed, or consumed by the global chemical industry. Many of these chemicals may be sufficiently hazardous to be a threat, either by deliberate or accidental release. The release of large volumes of hazardous chemicals (HAZCHEMs) can produce environmental damage that could result in pollution of water supplies and long-term ecological damage.

c. Beyond their toxicity, TIM can have other significant hazards. Industrial chemicals are often corrosive and can damage the eyes, skin, respiratory tract, and equipment (especially electronic equipment). Many industrial materials are flammable, explosive, or react violently with air or water. These hazards can be greater than the immediate toxic effects from an industrial chemical release. Most industrial chemicals can have both short-term and long-term health effects, ranging from short-term transient effects to long-term disability, to rapid death.

d. Military protection and detection and medical countermeasures are not specifically designed for the hazards from TIM. Often there are no specific antidotes for TIC.

e. Although the hazards of weaponized chemicals have long been recognized, the hazards of industrial materials have only recently become more widely understood. Deliberate or inadvertent release of TIM significantly increases hazards to the indigenous population and US forces. While CW agents are highly toxic and lethal in small amounts, the countries producing them are generally known and are few in numbers when compared with the quantities and universal nature of TIM. TIM should be recognized for the multiple

health hazards they pose as well as the potential risks resulting from an explosion or fire-associated products. Most TIM will present a vapor (inhalation) hazard. Vapor concentration at or near the point of release may be very high and may reduce the oxygen concentration below that required to support life. These TIM are generally in one of the following categories.

- Agricultural. Includes insecticides, herbicides, and fertilizers.

- Industrial. Chemical and radiological materials used in manufacturing processes or for cleaning.

- Production and Research. Chemical or biological materials produced or stored in a facility.

- Radiological. Nuclear power plants, medical facilities/laboratories, uranium mining and refining operations, nuclear-fuel fabrication, and radiological-waste storage operations.

2. TIM-Operations Planning

Before any operation, the response element develops an understanding of the potential hazard from TIM in the area of concern. Furthermore, information collection requirements that can support vulnerability analysis and assessment during the planning process (deliberate or crisis action) include some of the following key factors:

a. Identifying all possible industrial plants, storage sites, and shipment depots.

b. Identifying TIM routinely produced, used, or processed in the area. Knowledge of the manufacturing process used at an industrial plant is especially important as TIM are often used as intermediates in the productions of plastics, pesticides, and herbicides.

c. Assessing the effects of the release of TIM either as a result of collateral damage or an accident.

d. Assessing whether the deliberate release of a TIM is realistic in this particular situation. Factors that should be considered in this assessment are as follows:

- Favorable terrain and meteorological conditions.

- Political environment (serves as a bargaining chip).

- Insignificant punishment or retaliation policy in place.

- Military advantage or benefit to be gained.

- Psychological impact.

e. Identifying local hazard-management procedures and civilian agencies responsible for handling HAZMAT incidents. These contacts should be noted for quick reference.

f. Identifying local hazard identification labeling and placarding systems. A reference sheet listing local names for high-hazard industrial chemicals should be developed for use in the field.

g. Assessing the need for special detectors and modifications of detectors, such as CAMs.

h. Assessing the need for specialized protection equipment, such as the SCBA or special chemical suits.

i. Assessing potential information items for the commander. These items include the following:

- How does one determine if there is a potential threat?
- Is there a special way one needs to react to these chemicals that is different from the way he has been trained?
- Where is it safe to be?
- How much exposure is safe?
- What decontamination equipment can be used or is needed?
- What are the short-term and long-term health effects?
- What are the effects on noncombatants?
- What are the effects on military equipment?

3. TIM Information-Management Resources

a. The US DOT Emergency Response Guidebook lists HAZMATs commonly shipped in the US. This publication is a guide for first responders during the initial phase of a HAZMAT incident. It highlights especially hazardous materials and provides an index of protective actions to take and a table of initial isolation and protective-action distances.

b. The NIOSH Pocket Guide to Chemical Hazards provides reference information in a table format, which can be used for hazard assessment and management. The information includes chemical names, synonyms, trade names, exposure limits, physical and chemical properties, chemical incompatibilities and reactivities, personal protection measures, and health hazards.

4. Protective-Action-Zones Determination

Plans supporting PAZs for each hazard site and immediate evacuation from the hazard's path are the best defense against the TIM hazard. As a minimum, commanders should consult with the engineer officer, NBC defense officer, legal officer, medical officer, intelligence officer, PM, and PAO when planning PAZs. These staff officers can provide guidance for hazard isolation, entry denial, evacuation, and in-place protection.

a. Isolate Hazard Area/Deny Entry. Isolating the hazard area establishes control and is the first step for protective actions that follow. Exclude personnel not directly involved in responding to the hazard, especially responding personnel that are not adequately protected. The initial isolation zone will include upwind distances from the incident that may contain dangerous concentrations.

b. Evacuate/Shelter in Place. When the time and mission allow, evacuation is the best protective response to a TIM hazard. Evacuate personnel closest to the hazard and outdoors (those in direct view of the scene first). The use of PAZ estimates assume that random wind-direction changes confine the hazard-vapor plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective-action distance equal to the downwind protective-action distance. Evacuation measures must also consider that water-reactive poison inhalation hazards (PIH) making their way into streams will move with the current and stretch the hazard substantial distances from the hazard point.

Table G-1. Example of a Hazard Response Guide (Mixed Load/Unidentified Cargo)

POTENTIAL HAZARD

FIRE OR EXPLOSION

- Substance may explode from heat, shock, friction, or contamination.
- Substance may be ignited by heat, sparks, or flames.
- Vapors may travel to the source of ignition and flash back.
- Containers may explode when heated.

HEALTH

- Inhalation of, ingestion of, or contact with the substance may cause severe injury, irritation, disease, or death.
- High concentrations of gas may cause asphyxiation without warning.
- Contact with the substance may cause burns to the skin and eyes.
- Runoff from fire control may cause pollution.

PUBLIC SAFETY

PROTECTIVE CLOTHING

- Positive pressure SCBA should be worn.
- Structural firefighters' protective clothing will only provide limited protection.

EVACUATION

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- If a tank, rail car, or tank truck is involved in a fire, ISOLATE the surrounding area for 800 meters. Also, consider the initial evacuation of persons in the surrounding areas for 900 meters.

EMERGENCY RESPONSE

FIRE

- **CAUTION: Material may react with extinguishing agent.**

- **Small Fires**
  - Use dry chemical (CO_2) and spray with water or use regular foam.
- **Large Fires**
  - Spray with water or use fog or regular foam.
  - Move the containers from the fire area if it can be done without risk.
- **Fire Involving Tanks**
  - Cool containers with flooding quantities of water until well after the fire is out.
  - Do not get water inside the containers.
  - Withdraw immediately in case of a rising sound from venting safety devices or discoloration of the tank.
  - ALWAYS stay away from the ends of the tanks.

FIRST AID

- Move the victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if the victim is not breathing.
- Do not use the mouth-to-mouth method if victim ingested or inhaled the substances; use other approved respiration devices equipped with a one-way valve.
- Remove and isolate contaminated clothing.
- Administer oxygen if breathing is difficult.
- Shower and wash with soap and water.
- Note that the effects of exposure (inhalation, ingestion, or skin contact) may be delayed.
- Ensure that medical personnel are aware of the material(s) involved and that they take precautions to protect themselves.

(1) When evacuating the hazard area, individuals should wear clothing that prevents deposition of liquid on and minimizes injury to exposed skin.

(2) Do not permit evacuees to congregate at established safe distances. Evacuation to established safe distance does not guarantee complete safety for evacuated personnel. When possible, move evacuated personnel to a designated location by a specific route, and to a distance where additional movement is not required following a radical wind shift.

(3) Use in-place protection when evacuation may cause greater risk than remaining in place. In-place protection may not be an option if the TIM vapors are flammable, the hazard is persistent, or buildings cannot be closed tightly. Warn persons that are protected in place to stay clear of windows due to the danger from glass and projectiles in the event of a fire and explosion.

(4) Maintain communications with in-place protected personnel to advise them of changing conditions. Communications is a psychological lifeline for personnel cutoff from freedom of movement and information.

5. Vulnerability Mitigation

Selected measures that support vulnerability mitigation include securing key information, assessing vulnerability, conducting detection, and taking protective measures.

a. Securing Key Information. Each TIM incident has special problems and considerations. During planning, attempt to secure pertinent information involving production, storage facilities, distribution, and transportation of TIM. As a minimum, obtain the type, quantity, and specific risk from fire, explosion, toxicity, corrosive effects, and/or persistency of gas. Sources for this information include appropriate scientific or civilian industrial personnel, CW treaty experts, safety reports, and materiel safety data sheets (MSDS) on the facility, international code markings on storage tanks, and local civilian authorities that have emergency-response procedures and resources.

b. Assessing Vulnerability.

(1) A thorough vulnerability analysis provides an initial estimate of the threat and is the first step toward mitigating the operational effects of damage or destruction of a TIM facility. Determining the TIM hazard or threat and possible countermeasures in the area of operations is a primary responsibility of the medical and supporting PVNTMED staff. They are supported by the NBC and civil-affairs staffs. Before entry into the area, area assessment teams provide information involving TIM hazard production, storage facilities, and suspected hazard areas.

(2) Military protection and decontamination equipment was not designed for handling TICs. For proper handling, protection, and hazard-management information, responders seek guidance from their C^2 element. Other sources for assistance include the Chemical Transportation Emergency Center (CHEMTREC) hot line, for emergency

assistance within the US/Canada: 1-800-424-9300 or outside CONUS: 1-202-483-7617 (toll free if necessary). Commanders also identify the local civilian authorities that may have additional emergency-response procedures and resources, which can be used.

c. Conducting Detection. Some plants, facilities, storage containers, or transport containers may be identified by markers. These could take the form of international HAZCHEM markers that are diamond shaped and contain information that can be used to identify the exact industrial chemical. When encountering a suspect industrial chemical, attempt to identify the exact TIM and all possible information on the materials.

(1) Additionally, standard in-service chemical detectors are designed only to detect CW gases. Detection of TIC can, in some circumstances, be made by in-service military chemical-detection systems.

(2) Several industrial detection systems are available for the rapid detection of specific industrial chemicals, such as chlorine or ammonia. Detection systems, such as the Dräger detector system, can be used for detecting and determining the concentration of a large number of dangerous chemicals. This system comes in the form of a simple kit, which uses individual tubes to detect a variety for specific industrial chemicals. Such systems can be supplied to units operating in an area where there is a known hazard from industrial chemicals.

d. Taking Protective Measures. For fire fighting, the SCBA must be used when entering any enclosed space where there has been a TIM spill or to perform clean-up work. The individual protective mask (NBC mask) does not afford sufficient protection within the immediate hazard zone where extremely high concentrations of industrial chemicals such as ammonia may occur and where the lack of oxygen requires the use of the SCBA. The military respirator should only be used for emergency protection against the immediate effects of a toxic release and while evacuating from the immediate hazard zone. Further, military chemical protective suits (MOPP gear) are not designed for providing protection against TIC.

6. TIM Precautions

a. Personnel or equipment that may have been contaminated with TIC can be decontaminated by washing with large amounts of warm, soapy water. Contaminated clothing should be immediately removed and disposed of in a safe manner; however, when no release has occurred, establish a minimum safety EZ based upon mission requirements, surveys, and assessments of the TIM facility.

b. If a TIM release occurs, evacuate beyond the safety EZ established by the incident or on-site commander. When mission requirements dictate entering the EZ for unknown TIMs, personnel should wear, at minimum, a positive pressure SCBA (pressure demand), a fully encapsulated (Level A) chemical-resistant suit, chemical-resistant inner gloves, chemical-resistant outer gloves, two-way radio communications, and other recommended safety equipment, as appropriate.

NOTE: MOPP gear does not equal a fully encapsulated chemical-resistant suit.

c. Reduce safety exclusion areas only after a detailed survey and assessment of the extent of the probable hazard area. When friendly units are required to operate in an area where a potential TIM facility exists, defense planning should include actions such as the following:

- Coordinate with civil HN emergency-response teams.

- Identify the probable TIM, extent of possible contamination, minimum protective equipment, and personnel safety considerations.

- Coordinate with higher HQ and the HN to identify support availability.

- Develop an incident response plan. For detailed information and procedures for response plans, refer to service-specific publications that provide templates for plan development (i.e., Air Force Instruction [AFI] 32-4001, Air Force Manual [AFM] 32-4004, and AFM 32-4013).

- Implement the TIM reconnaissance plan and assign units to prepare and execute the recon missions.

- Use commercial detectors (i.e., Dräger tubes), which can provide confirmation of individual TIM. However, chemical reactions and combustion by-products may produce toxic products that are not identified by these detectors.

- Coordinate with theater medical elements (e.g., PVNTMED team) for follow-on industrial hygiene assessments, as dictated by mission requirements.

- Coordinate with in-theater TEU elements for follow-on technical support if appropriate.

- Coordinate with engineer elements if the facility in question was damaged or destroyed or if assessments indicate it is abandoned.

- Coordinate with decontamination elements for decontamination of contaminated personnel and equipment.

- Coordinate for delivery of collected samples to the in-theater supporting medical laboratory.

- Avoid hazard areas as long as possible. When conducting reconnaissance or rescue operations near or within the hazard, equip ground survey teams with respiratory protection (i.e., SCBA) and skin protection certified for the TIM. Use aerial, visual reconnaissance to help collect C^2 information to assist with incident management.

NOTE: See FM 8-500 for first-responder guidance to a TIM incident.

7. Risk-Management Summary

a. Exposure Guidance. Exposures exceeding the permissible exposure limits and published exposure levels immediately dangerous to life and health (IDLH) mandate PPE commensurate with the hazard.

b. Potential Skin Absorption and Irritation Sources. Evaluate the hazard for water and air reactivity; explosive, combustible, or other mixture hazards; and toxicity hazards. Mark and template potential hazard zones, and plan and institute protective measures.

c. Potential Eye Irritation Sources. Provide individual protective equipment or other protective measures to keep individual exposure within the prescribed safe limits.

d. Oxygen Deficiency. Evaluate hazards that might cause decreases in the oxygen level and install warning devices that alert to oxygen-deficient levels.